IEC 60096-0-1

Edition 3.1 2017-01
CONSOLIDATED VERSION

INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

Radio frequency cables –
Part 0-1: Guidelines to the design of detail specifications – Coaxial cables

Câbles pour fréquences radioélectriques –
Partie 0-1: Lignes directrices pour la conception des spécifications particulières – Câbles coaxiaux

IEC 60096-0-1:2012-10+AMD1:2017-01 CSV(en-fr)

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INTERNATIONAL
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INTERNATIONALE

ICS 33.120.10

ISBN 978-2-8322-3911-7

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IEC 60096-0-1

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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FOREWORD

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This consolidated version of the official IEC Standard and its amendment has been prepared for user convenience.

IEC 60096-0-1 edition 3.1 contains the third edition (2012-10) [documents 46A/1043/FDIS and 46A/1064/RVD] and its amendment 1 (2017-01) [documents 46A/1317/FDIS and 46A/1321/RVD].

In this Redline version, a vertical line in the margin shows where the technical content is modified by amendment 1. Additions are in green text, deletions are in strikethrough red text. A separate Final version with all changes accepted is available in this publication.

International standard IEC 60096-0-1 has been prepared by subcommittee 46A: Coaxial cables, of IEC technical committee 46: Cables, wires, waveguides, R.F. connectors, R.F. and microwave passive components and accessories.

This third edition constitutes a technical revision.

The significant changes with respect to the previous edition are as follows:

– tables of material constants and factors and have been updated, different equations have been updated and corrected;
– a subclause dealing with the calculation of “Current carrying capacity of coaxial cables” has been added as Subclause 7.7.

A list of all the parts in the IEC 60096 series, published under the general title *Radio frequency cables*, can be found on the IEC website.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of the base publication and its amendment will remain unchanged until the stability date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

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RADIO FREQUENCY CABLES –

Part 0-1: Guidelines to the design of detail specifications – Coaxial cables

1 Scope

This part of IEC 60096 provides guidance for the design of radio frequency coaxial cables with braid, metallic tapes or tubular outer conductors.

2 Normative references

Void.

3 Symbols and numbering

3.1 Register of symbols used

Symbol	Designation	Unit
α	Total attenuation per unit length, 20 °C	dB/100 m
α_T	Total attenuation per unit length, $T \neq 20$ °C	dB/100 m
α_x	Attenuation due to element *x*, 20 °C	dB/100 m
β_x	Braid angle of element *x*	° (degree)
γ_x	Density of the material of element *x*	g/cm^3
δ_x	Loss angle of the material of element *x*	rad
ε_x	Relative dielectric permittivity of the material of element *x*	–
χ_x	Conductivity of the material of element *x*, 20 °C	m/Ωmm^2
σ_x	Thermal resistivity of the material of element *x*	K·m/W
B_x	Braid coverage concerning element *x*	–
c_o	Velocity of propagation in free space	m/s
C	Dielectric diameter	mm
C_x	Capacitance of element *x*, per unit length	pF/m
d_x	Diameter of individual wires of element *x*	mm
D_x	Outer diameter of element *x*	mm
D_{xe}	Electrical effective diameter of element *x*	mm
D_{xm}	Mean diameter of element *x*	mm
D	Sheath diameter	mm
D_s	Outer conductor diameter	mm
d	Center conductor diameter	mm
E_2	Maximum permissible voltage gradient of dielectric (peak value)	kV/mm
ε	Surface emissivity (sheathed=0,95, bare=0,35)	
f	Frequency	MHz
h_x	Coating thickness concerning element *x*	mm
I	Current carrying capacity (Amperes)	
k_x , k_{xy}	Calculation factors according to Tables 1 and 2	–
L_x	Braid lay length concerning element *x*	mm

Symbol	Designation	Unit
ln	Natural logarithm	
m	Total weight of cable per unit length	g/m
m_x	Weight of element *x*	g/m
N_1	Number of stranded wires of inner conductors	–
N_x	Number of wires to each spindle concerning braid *x*	–
n	Number of cables	
n_x	Number of spindles in the braid concerning element *x*	–
P_{40}	Maximum permissible input power, ambient temperature 40 °C	W
P_i	Thermal resistivity of the dielectric material, Typically = 13,0 K·m/W for both foam, disc and air dielectrics	
P_j	Thermal resistivity of the sheath material, Typically = 3,5 K·m/W for polyethylene Typically = 7,0 K·m/W for polyvinylchloride (PVC) sheaths	
P_T	Maximum permissible input power, ambient temperature $T \neq 40$ °C	W
P_d	Maximum permissible dissipation power per unit length	W/m
q_x	Filling factor of braid concerning element *x*	–
R_x	DC resistance of conductive element *x*, per unit length	Ω/m
	and insulation resistance of insulating element *x* respectively	MΩ·km
R_{ic}	Inner conductor resistance	Ω/m at t_a
R_{ictc}	Inner conductor resistance at conductor operating temperature (t_c)	
R_{oc}	Outer conductor resistance	Ω/m at t_a
R_{octc}	Outer conductor resistance at conductor operating temperature (t_c)	
R_{eoc}	Increase in R_{ic} due to effect of outer conductor	
R_{th}	Total thermal resistance of circuit	K.m/W
R_i	Thermal resistance of dielectric	K.m/W
R_j	Thermal resistance of sheath	K.m/W
s_x	Nominal thickness of element *x*	mm
$s_{xmin.}$	Minimal thickness of element *x*	mm
T_x	Temperature of element *x*	°C
T_a	Ambient temperature	°C
t_c	Conductor operating temperature	°C
t_a	Ambient temperature	°C
t_s	Cable surface temperature	°C
U_t	Test voltage (40 Hz - 60 Hz), rounded r.m.s. value	kV
U_{tc}	Test voltage (40 Hz - 60 Hz), rounded r.m.s. value	kV
U_d	Discharge test voltage, r.m.s. value	kV
U_o	Maximum permissible operating voltage, rounded r.m.s. value	kV
U_{oc}	Maximum permissible operating voltage, calculated r.m.s. value	kV
v_r	Velocity ratio	–
z_o	Characteristic impedance, nominal value	Ω

3.2 Numbering of construction elements

Numbering of construction elements in the following tables are as follows:

1 Inner conductor
2 Dielectric
3 Outer conductor
4 Sheath
5 Medium between outer conductor and screen
6 Screen
7 Medium between first and second screen
8 Second screen
etc.

Examples of use of k_x factor are given in Table 1.

Table 1 – Example of use of k_x factor

Symbol	Designation	Unit
k_2	Factor dependent on inner conductor concerning the voltage gradient in the dielectric	–
k_4	Thermal dissipation constant of sheath surface in air	W/m^{2}K^{1,25}

Examples of use of k_{xy} factor are given in Table 2.

Table 2 – Example of use of k_{xy} factor

Factor	Construction element concerned			
	1	**3**	**6**	**8**
Coating factor	k_{1c}	k_{3c}		
Stranding or braiding factor:				
– concerning attenuation	k_{1a}	k_{3a}		
– concerning d.c. resistance and weight	k_{1r}	k_{3r}	k_{6r}	k_{8r}
Ratio between overall diameter and diameter of individual wires	k_{1d}			
Effective diameter factor concerning characteristic impedance	k_{1z}			

4 Material constants

4.1 Table of material constants relating to dielectric and sheath and their values for different materials

Material constants relating to dielectric and sheath and their values for different materials are given in Table 3.

Table 3 – Material constants relating to dielectric and sheath and their values for different materials

Symbol	Designation	Unit	Value for [a]										
			Solid PE	Semi-air-spaced PE	Cellular [b] PE			PTFE	FEP	Cellular [b] FEP	ETFE	PFA	PVC
ε_2	Permittivity of dielectric	–	2,28	1,4	1,3	1,5	1,7	2,1	2,1	1,5	2,6	2,1	
tan δ_2	Dissipation factor of dielectric	–	$2,5 \times 10^{-4}$	$2,5 \times 10^{-4}$	4×10^{-4}	6×10^{-4}	6×10^{-4}	[c]	[f]	$1,2 \times 10^{-3}$	[e]	[e]	
E_2	Maximum permissible voltage gradient of dielectric	kV/mm	11	2	2	2	2	11		2	[e]	[e]	
γ_2, γ_4	Density of dielectric and sheath	g/cm³	0,93	0,36	0,28	0,44	0,58	2,2	2,2	0,90	1,7	2,2	1,4 [b]
σ_2, σ_4	Thermal resistivity of dielectric and sheath	K • m/W	3,5	[e]	15	9	6	4,4	5,0	[e]	4,4	4,5	7,0
T_1	Maximum permissible operating temperature	°C	85/80 [d]	85/80 [d]	70	70	70	250	200 [g]	200 [g]	150 [g]	200 [g]	70

Table 3 *(continued)*

a PE = polyethylene
PTFE = polytetrafluoroethylene
FEP = fluorinated ethylene propylene
ETFE = ethylenetetrafluoroethylene
PFA = perfluoroalcoxylalkane
PVC = polyvinylchloride

b Typical value(s).

c

Frequency MHz	**tan** δ**2**
1	1×10^{-4}
101	$1{,}5\times10^{-4}$
102	$2{,}5\times10^{-4}$
103	$4{,}3\times10^{-4}$
104	2×10^{-4}

d 85 °C: high density material.
80 °C: other density material.

e Under consideration

f

Frequency MHz	**tan** δ**2**
1	4×10^{-4}
101	4×10^{-4}
102	8×10^{-4}
103	10×10^{-4}
2×103	10×10^{-4}
104	7×10^{-4}

g In the case of silvered inner and outer conductors only.